

WHAT IS CLAIMED IS:

1 1. An alkaline battery comprising:
2 a cathode comprising an active cathode material including lambda-manganese
3 dioxide;
4 an anode comprising zinc;
5 a separator between the anode and the cathode; and
6 an alkaline electrolyte contacting the anode and the cathode,
7 wherein the active cathode material has a specific discharge capacity to a 0.8V cutoff
8 of greater than 290 mAh/g at a discharge rate of 20 mA/g of active cathode material.

1 2. The battery of claim 1, wherein the active cathode material has a specific
2 discharge capacity to a 0.8V cutoff of greater than 300 mAh/g at a discharge rate of 20 mA/g
3 of active cathode material.

1 3. The battery of claim 1, wherein the battery has a specific discharge capacity to
2 a 0.8V cutoff of 310 mAh/g or greater at a discharge rate of 20 mA/g of active cathode
3 material.

1 4. The battery of claim 1, wherein the lambda-manganese dioxide is heated to a
2 temperature of less than 150°C.

1 5. The battery of claim 1, wherein the lambda-manganese dioxide is heated to at
2 a temperature of 120°C or less.

1 6. The battery of claim 1, wherein the lambda-manganese dioxide has a B.E.T.
2 surface area of greater than 4 m²/g.

1 7. The battery of claim 1, wherein the lambda-manganese dioxide has a B.E.T.
2 surface area of greater than 8 m²/g.

1 8. The battery of claim 1, wherein the lambda-manganese dioxide has a total
2 pore volume of from 0.05 to 0.15 cubic centimeters per gram.

1 9. An alkaline battery comprising:
2 a cathode comprising an active cathode material including lambda-manganese
3 dioxide having a total pore volume of from 0.05 to 0.15 cubic centimeters per gram, and the
4 lambda-manganese dioxide has a B.E.T. surface area of greater than $8 \text{ m}^2/\text{g}$, wherein the
5 lambda-manganese dioxide is heated to a temperature of 150°C or less;
6 an anode including zinc;
7 a separator between the anode and the cathode; and
8 an electrolyte contacting the cathode, the anode and the separator.

1 10. The battery of claim 9, wherein the active cathode material has a specific
2 discharge capacity to a 0.8V cutoff of greater than 290 mAh/g at a discharge rate of 20 mA/g
3 of active cathode material.

1 11. The electrochemical cell of claim 10, wherein the active cathode material has
2 a specific discharge capacity to a 0.8V cutoff of greater than 300 mAh/g at a discharge rate of
3 20 mA/g of active cathode material.

1 12. A method of manufacturing an alkaline battery comprising:
2 providing a positive electrode including an active cathode material including
3 lambda-manganese oxide; and
4 forming a battery including the positive electrode and a zinc electrode,
5 wherein the active cathode material has a specific discharge capacity to a 0.8V cutoff
6 of greater than 300 mAh/g at a discharge rate of 20 mA/g of active cathode material.

1 13. The method of claim 12, wherein providing the electrode includes preparing
2 lambda-manganese dioxide by a method comprising:
3 contacting water with a compound of the formula $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_4$, wherein x is

4 from -0.02 to +0.02;

5 adding an acid to the water and compound until the water has a pH of 1 or
6 less;

7 separating a solid from the water and acid; and

8 drying the solid at a temperature of 120°C or below to obtain the lambda-
9 manganese dioxide.

1 14. The method of claim 13, wherein the compound has a B.E.T. surface area of
2 between 1 and 10 m²/g.

1 15. The method of claim 13, wherein the compound has a total pore volume of
2 between 0.05 and 0.15 cubic centimeters per gram.

1 16. The method of claim 13, wherein the compound of the formula $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_4$
2 has a spinel-type crystal structure.

1 17. The method of claim 13, wherein the solid is dried at a temperature of less
2 than about 100°C.

1 18. The method of claim 13, wherein the solid is dried at a temperature between
2 50°C and 70°C.

1 19. The method of claim 13, wherein x is from -0.005 to +0.005.

1 20. The method of claim 13, wherein contacting water and the compound includes
2 forming a slurry.

1 21. The method of claim 20, wherein the slurry is maintained at a temperature
2 below 50°C.

1 22. The method of claim 13, wherein the acid concentration is between 1 and 8
2 molar.

1 23. The method of claim 13, wherein the acid is sulfuric acid, nitric acid,
2 perchloric acid, hydrochloric acid, toluene sulfonic acid, or trifluoromethyl sulfonic acid.

1 24. The method of claim 20, wherein the temperature of the slurry is maintained
2 substantially constant during the addition of acid.

1 25. The method of claim 13, wherein the pH is 1 or less.

1 26. The method of claim 13, further comprising washing the solid separated from
2 the water and acid with water until the washings have a pH greater than 6.